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**FINAL**  
**Preliminary Assessment/Site Inspection**  
**Report**

**Abandoned Mines Within the  
Hassayampa River Watershed  
Prescott, Arizona**

EPA ID Nos.:

Senator Mine - AZ0000309211  
Storm Cloud Mine - AZ0001038546  
Sundance Mine - AZ0001039379  
McClellan Tailings - AZ0000309096  
Lion Adit - AZN000905896  
Holiday Girl Mine - AZ0001038785  
McKinley Mill - AZN000905897

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relative threat associated with actual or potential releases of hazardous substances at a site. The HRS has been adopted by the EPA to help set priorities for further evaluation and eventual remedial action at hazardous waste sites. The HRS is the primary method of determining a site's eligibility for placement on the National Priorities List (NPL). The NPL identifies sites at which the EPA may conduct remedial response actions. This report summarizes the results of the PA/SI for the HRW Study Area.

## **1.1 APPARENT PROBLEM**

The apparent problems in the HRW Study Area, which contributed to the EPA's determination that a PA/SI was necessary, are as follows:

- Historic mining activities from 1863 to the mid 1950s in the upper HRW Study Area led to the degradation of surface water quality. Many of the mining waste dumps and tailings pile/waste rock are located in riparian environments along stream banks (URS, 1994).
- Surface water samples collected in 1986 by the EPA near the Senator Mine contained the hazardous substances cadmium, copper, iron, lead, manganese, mercury, and zinc at concentrations greater than their respective benchmarks under Ambient Water Quality Criteria (AWQC) (URS, 1994).
- Sediment samples collected in 1987 by Arizona Game & Fish Department near the Senator Mine contained the hazardous substance lead at concentrations greater than the Arizona Health Based Guidance Level (HBGL) for lead.
- Surface water samples collected in 1990 by DBA from the HRW Study Area contained the hazardous substances arsenic, cadmium, copper, lead, manganese, mercury, and zinc at concentrations greater than three times the background concentrations. With the exception of arsenic and manganese, the concentrations were also greater than their respective benchmarks under the Ambient Water Quality Criteria (URS, 1994).



- Latitude: North 34 degrees, 25 minutes, 17.680 seconds
- Longitude: West 112 degrees, 25 minutes, and 43.688 seconds

The tailings associated with the Sundance Mine are situated on a moderate slope trending southeast and are approximately 400 feet topographically upgradient from a tributary that enters the Hassayampa River. The estimated surface area of the tailings is 2,150 square feet. Run-off flows across the tailings via surface sheet flow towards the tributary to the Hassayampa River. The tailings are located on private land (Cartwright, Jr. 1996). According to ADMMR records, the Sundance Mine is located on the "Senator south extension claim". A claim map identifies this area as the Ten Spot Claim. See Figure 3-3 for the Sundance Mine Site Map.

#### **2.2.4 McCleur Tailings**

McCleur Tailings is located in Township 12.5 North, Range 2 East, Section 36. The tailings are located adjacent to the McCleur Claim, a subsection of the Storm Cloud Mine. Although the records for the McCleur Claim can be found in the ADMMR file for the Storm Cloud Mine, no locational information for the McCleur Tailings is available in the ADMMR files.

WESTON located the following coordinates for this Site:

- Latitude: North 34 degrees, 25 minutes, 25.585 seconds
- Longitude: West 112 degrees, 25 minutes, and 34.320 seconds

The tailings at the McCleur Site are situated in a relatively flat valley bottom in a linear shape, roughly contouring the drainage. The tailings span an area that is intersected by two separate drainages - one from the Sundance Mine (mentioned above) to the southwest and the other from the Storm Cloud Mine (also mentioned above) to the southeast. A domestic well is located approximately 30 feet east of the tailings (DBS, 1990). The surface area of the tailings is approximately 10,986 square feet. Water flowing aboveground in the drainage comes in direct



The Sundance Mine consists of six patented claims. Production from the mine began in the early 1900s. Ore from the mine was milled in a small plant just below the mine on the Hassayampa River. In 1942, the Sundance Mine was acquired by Mr. Dick W. Martin of Prescott, Arizona and Mr. E.F. Rippey of Phoenix, Arizona. The mine was worked at the 150 ft level in leasing operations subsequent to the 1942 purchase. ADMMR records indicate that all ore from the leasing operations was extracted and shipped (destination unknown). Reports also indicate that lower levels of the mine, although thought to be in ore, were not dewatered for operation as of a 1956 correspondence from Mr. Mark Gemmill, Field Engineer with the Arizona Department of Mineral Resources. One report, Status of Dormant Mines (August 5, 1950), states that there is an indication of possible uranium ores in three places on the property. No other information regarding the claim of uranium ore was found.

#### **2.3.4 Operational History of McCleure Tailings**

It is believed that the McCleure Tailings is the same claim that is listed for the Storm Cloud Group. See Section 2.3.2 of this report for more details. The shaft on the McCleure Claim, known as the Ten Spot, was reportedly 267 ft deep with two crosscuts each at depths of 80 ft bgs and 237 ft bgs (Colvocoresses, 1934).

#### **2.3.5 Operational History of the Lion Adit**

The Lion Adit appears to be adjacent to (and possibly connected with) the Lion Claim, which is listed as part of the Storm Cloud Group. See Section 2.3.2 of this report for more details. During site visits conducted in April and August 2001, no waste rock or tailings pile were evident at this location, but water was observed discharging from the adit.

#### **2.3.6 Operational History of Holiday Girl Mine**

No specific records for the Holiday Girl Mine are maintained by the ADMMR. No specific information is known about the operations at this particular location. However, during site visits



HRW Study Area. As part of the Priority Pollutant Sampling Program conducted in 1993, ADEQ collected surface water and sediment samples from the Hassayampa River and Lake Hassayampa. The details of this sampling can be found in Section 3.0 of this report.

#### **2.4.5 Arizona Department of Game & Fish**

The Arizona Department of Game & Fish (ADGF) is interested in the results of the EPA's investigation since there could potentially be a direct impact on the quality of life for the game & fish in the vicinity of the HRW Study Area. According to a December 8, 1995 report by CDM, the ADGF conducted sampling and analysis of waters and sediments in the Hassayampa and Lynx Creek watersheds to determine the effects of historical mine sites on the watersheds (CDM, 1995). The results of this sampling are discussed in Section 3.0 of this report.

#### **2.4.6 Arizona Department of Health Services**

The ADHS has performed periodic groundwater sampling dates within the HRW Study Area to determine if past mining activities in the area has affected the drinking water. The ADHS has been working in conjunction with the EPA Community Involvement Office to ensure that proper notice of sampling activities is provided to residents. Refer to Section 3.1.4





### **3.0 INVESTIGATIVE EFFORTS**

#### **3.1 PREVIOUS SAMPLING**

Previous sampling has been conducted by various parties over the past two decades. The sample types include soil, surface water, groundwater and sediment. Analytical results for a portion of the samples revealed levels of contaminants (i.e. antimony, arsenic, cadmium, lead, and selenium) above applicable benchmarks or background levels. However, the supporting QA/QC samples were not adequate to support the data for use in HRS scoring.

##### **3.1.1 Previous Soil Sampling**

Daniel B. Stevens & Associates, Inc. of Albuquerque, New Mexico conducted a field reconnaissance and sampling effort in the site area from July 15 to July 19, 1990. Abandoned mines and mills were visually examined for drainage and the presence of tailings. Temperature, pH, conductivity, iron, and zinc measurements were made in the field where mine drainage was present and from tributaries of the Hassayampa River. Preliminary information was used to determine which mines warranted collection of samples for further analyses. Soil samples were collected from sites most likely to be impacting the environment (URS, 1995). A total of eight soil samples were collected, including a background sample. The samples were collected from depths of 2 to 8 inches below ground surface (bgs) and were analyzed using EPA Methods 9010, 3050, 3010, and 245.1. A brief description of the soil sample locations is listed in Table 3-1.

The analytical results provided in Table 3-2 indicate that soil samples had elevated concentrations of the hazardous substances copper, lead, arsenic, nickel, cadmium, and zinc, which were both greater than three times the background concentrations and above applicable benchmarks (i.e. EPA PRGs, Arizona SRLs, and NOAA TELs).

In May of 1999, E&E collected eight soil samples (including two duplicates) from the Storm Cloud Mine and McClellan Tailings. All samples were analyzed for RCRA metals. The samples consisted



of surficial soils from the tailings pile/waste rock at each location. Three soil samples were collected from the Storm Cloud Mine and five soil samples were collected from the McClellan Tailings, including two duplicates. The locations are described in Table 3-3.

The analytical results provided in Table 3-4 indicate that soil samples had elevated concentrations of arsenic above the ADEQ SRL, residential (10 mg/kg) (no background samples were collected for comparison).

### 3.1.2 Sediment Sampling

The Arizona Department of Game & Fish conducted sampling and analyses of sediments in the HRW Study Area in 1987. The purpose of the sampling effort was to determine the ongoing effects of historical mine sites on the watershed. A total of three sediment samples were collected - one at the Senator Mine, one from the Hassayampa River as it discharges into Hassayampa Lake, and one from the Hassayampa River, above the Senator Mine. These samples were analyzed for copper, iron, lead, and zinc. Results of this sediment sampling event revealed that a lead concentration of 1,702 mg/kg determined in sediment samples collected at the Senator Mine. This concentration is in excess of the 400 mg/kg Arizona HBGL for lead. No background samples were collected for comparison. Metals concentrations in the remaining two samples were below Arizona HBGLs (CDM, 1995).

ADEQ collected sediment samples in 1993 from three locations within the HRW Study Area. One sample was collected from Hassayampa Lake, one from the Hassayampa River downgradient from Senator Mine, and one near the Zonia Mine located 40 Kilometers downgradient from Hassayampa Lake. All samples were analyzed for metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, selenium, and thallium). The analytical results did not detect contaminants in the samples collected from Hassayampa Lake or near the Zonia Mine at concentrations above the HBGLs or greater than three times background concentrations. However, the samples collected near the Senator Mine (Table 3-5) contained hazardous substances (antimony, arsenic, beryllium,



cadmium, copper, and lead) at concentrations more than three times background levels and above the respective HBGL benchmarks (ADEQ, 1993).

CDM collected sediment samples from Lake Hassayampa on June 7, 1995. Four sediment samples were collected from the bottom of the lake and analyzed for metals. The depth of the lake varied from 5 feet near the inlet to 20 feet near the dam. The sample locations were placed along the long axis of the lake and were spaced approximately 100 feet apart, with sample # 1 starting at the inlet and sample #4 ending at the dam. Analytical results of sediment samples containing contaminant concentrations in excess of the Arizona HBGL for arsenic (0.76 mg/kg) are summarized in Table 3-6. The remaining contaminants were detected at concentrations below their respective Arizona HBGL benchmarks (CDM, 1995).

In May of 1999, E&E collected 25 sediment samples, including five duplicates from the HRW Study Area. The sediment samples were analyzed for RCRA metals. The general sampling locations and quantities are listed as follows:

- Four samples were collected near the Senator Mine (including one duplicate)
- One sample was collected with a duplicate from the Hassayampa River (over one mile downstream from the Senator Mine)
- One sample was collected from a drainage east of the Holiday Girl Mine
- Five samples were collected near the McClellan Tailings (including one duplicate)
- Two samples were collected near the Holiday Girl Mine
- Five samples were collected near the McKinley Mill (Wetlands Mine) (including two duplicates)
- Four samples were collected near the Storm Cloud Mine
- Two samples were collected near the Ten Spot Mine (not included in this PA/SI)



The sampling locations are described in more detail in Table 3-7.

Background samples were not collected during this sampling event. Therefore, the results are only compared to the Arizona SRLs, EPA PRGs, and NOAA TELs. Antimony, arsenic, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc were detected in sediment samples at concentrations above the respective benchmarks. Table 3-8 summarizes the sediment samples collected by E&E that contained metals at concentrations above the benchmark values (E&E, 1999).

### **3.1.3 Surface Water Sampling**

In 1986 the U.S. EPA collected surface water samples from the Hassayampa River upgradient and downgradient from Senator Mine. The study detected elevated concentrations of copper, cadmium, and zinc in the mine discharge that exceeded water quality standards (CDM, 1995). Specific information from this sampling event was not provided to WESTON to elaborate on the details of the investigation.

In 1990, DBS collected 11 surface water samples, including one background sample, from the HRW Study Area. The samples were analyzed for trace metals. The sample names and locations of the surface water samples are listed in Table 3-9. The analytical results of the surface water samples revealed that concentrations of cadmium, copper, mercury, and zinc were above the Arizona Water Quality Standards for Surface Water. The analytical results are listed in Table 3-10 per sample location (DBS, 1990).

In May 1999, E&E conducted surface water sampling of the HRW Study Area. Twenty surface water samples were collected, including five duplicate samples. The samples were analyzed for arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, molybdenum, nickel, selenium, and zinc. The sample names and location descriptions are listed in Table 3-11. The analytical results of the surface water samples revealed that concentrations of



Two soil samples were collected within the Sundance Mine site (Figure 3-3). The samples were collected from within the tailings at the site. No surface water or sediment samples were collected at this site. Based on discussions with EPA, prior reconnaissance visits indicate that a release to the surface water and sediment is not readily apparent. Additionally, the tailings are not located within or immediately adjacent to the drainage.

### 3.3.4 McCleur Tailings

Twelve samples were collected to evaluate the potential impacts from the McCleur Tailings Site (Figure 3-3). Three soil samples were collected (including one duplicate) from within the tailings at the site. Four surface water samples were collected. Both a filtered and an unfiltered surface water sample were collected from the following two locations:

- at the tailings
- upstream on the Storm Cloud drainage, before the convergence with the McCleur drainage

Five sediment samples were collected at each of the following four sampling locations:

- At the tailings
- Before the convergence of the McCleur drainage and the Storm Cloud drainage
- After the convergence of the McCleur drainage and the Storm Cloud drainage (and duplicate)
- Upstream on the Storm Cloud drainage, before the convergence with the McCleur drainage

The SAP planned for the collection of eighteen samples (including four duplicates) to be collected at the McCleur Tailings. Six surface water samples (including two duplicates) were eliminated from the sampling efforts due to a lack of water in the drainage. Portions of the drainage were flowing above ground at low flow rates and portions were dried up. Four surface water samples, bulleted above, were collected from the flowing portions of the drainage.

*NOTE: The surface water sample collected downstream of the Lion Audit located immediately*



## **4.0 HAZARD RANKING SYSTEM FACTORS**

### **4.1 SOURCES OF CONTAMINATION**

Hazardous substance sources associated with the HRW Study Area include, but may not be limited to:

- tailings pile/waste rock
- abandoned mines
- waste rock piles

Arsenic was detected in soil samples collected from the tailings pile and/or waste rock associated with the McKinley Mill Mine, Senator Mine, Sundance Mine, and Storm Cloud Mine at concentrations significantly greater than the area soil background levels. The Validated Analytical Results can be found in Appendix H.

### **4.2 SOIL EXPOSURE PATHWAY**

Soil samples were collected from each of the following tailings pile/waste rock piles:

- Senator Mine
- McClell Tailings
- Storm Cloud Mine
- McKinley Mine
- Sundance Mine
- Holiday Girl Mine



The analytical results for the soil samples collected from the tailings pile/waste rock detected concentrations of antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, and zinc significantly above the background levels established for the HRW Study Area. Therefore, a total of six separate areas of observed contamination were identified.

In addition to inorganic analyses, pH was analyzed in soil samples collected from the tailings pile/waste rock piles. The analytical results for pH were significantly more acidic than the corresponding background levels for the following soil sample locations: the McClell Tailings, McKinley Mine, Senator Mine, Storm Cloud Mine, and Holiday Girl.

The air pathway was not evaluated for the purposes of this report as no samples were collected to document an observed release to the air.

#### **4.2.1 Physical Conditions**

Each of the six sites listed above exist within the Prescott National Forest. However, they are surrounded by part-time and full-time residents. None of the sites are fenced or have any type of engineered covering over the waste rock and/or tailings piles. Although not suited for recreation, the areas create an attractive nuisance by the presence of historic mining equipment and colorful tailings pile/waste rock. Also, there are some manmade features, such as the swing at the Storm Cloud Mine; fire pits at the Senator and McClell Mines; and four-wheeler tracks at the Senator Mine, McKinley Mill, and the McClell Tailings, which indicate occasional recreational use of the area.

#### **4.2.2 Soil Targets**

The area primarily consists of residences. No industrial business centers or day care centers have been found in the HRW Study Area. The area also provides habitat to threatened and/or endangered species and potential wetlands identified in Section 4.3.2 of this report. Approximately 640 people live within a one-mile radius of the HRW Study Area. This approximation was obtained by drawing



a circle with a one-mile radius around each source on the 1974 topographic map. The outermost boundaries of the adjoined circles were used to define the area of interest. The house symbols on the topographic map within the area of interest were counted (a total of 60). The Regional Census Bureau was contacted for population data for the years 1970 (closest census to topographic map date) and 2000 for Yavapai County. The percent growth of the population for Yavapai County was calculated between these years (456%). The house count was then multiplied by the percent growth to get an up to date estimate for the area of interest (275 houses). According to the census there is an average of 2.33 people per home in Yavapai County. Therefore, 2.33 was multiplied by 275 homes for an estimated 640 people. (Regional Census Bureau, 2001). See Figure 4-1 for the 1-Mile Radius Population Map.

#### **4.2.3 Soil Exposure Conclusions**

An observed release has been established through chemical analysis through the collection of soil samples collected from various tailings piles/waste rock within the HRW. Antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, and zinc were detected at concentrations significantly greater than the corresponding background levels established for each rock type. The soil samples used to establish the observed release were collected from the HRW during the 2001 PA/SI field activities. For HRS scoring purposes, a hazardous substance concentration is considered significantly above background levels when one of the following two criteria is met: (1) the hazardous substance is detected in the contaminated sample, but is not detected in the background samples or (2) the hazardous substance is detected in the contaminated samples at a concentration equal to or greater than three times the maximum background level, when the hazardous substance is detected in the background samples. As mentioned previously, background soil samples were collected within the HRW from areas containing the same rock type and in similar environments as the source.

The analytical results indicated that hazardous substances were present at concentrations greater than





three times background levels at the tailings piles/waste rock located at the following sources: McKinley Mine, Senator Mine, McClellan Tailings, Sundance Mine, Storm Cloud Mine, and Holiday Girl Mine. See Tables 4-1 through 4-4 for soil metal analysis results. Table 4-11 presents soil pH results. See Figure 3-1 through 3-6 for the corresponding sample locations.

Hazardous substances significantly above background levels have been detected in the tailings piles/waste rock within the HRW. An estimated 640 people live within a 1 mile combined radius of the six sources within the HRW and evidence of human presence such as rope swings, fire pits, and four-wheeler tracks have been observed adjacent to and on the tailings/waste rock. In addition the area also provides habitat to threatened and/or endangered species and potential wetlands identified in Section 4.3.2 of this report.

### **4.3 GROUNDWATER PATHWAY**

The groundwater pathway was not evaluated due to site-specific conditions which would present difficulties in documenting a release to a groundwater resource used for drinking water purposes. The area is comprised of fractured bedrock. Thus, if a sample with elevated concentrations of heavy metals was collected and had sufficient QA/QC samples associated with it, it would be difficult to determine the source of the water. Although it is likely that surface water interfaces with groundwater, it is not possible to determine which surface water makes up drinking water from a specific well due to the number and varying orientation of the fractures within the aquifer.

Private domestic wells are located in the immediate vicinity of several of the mine sites evaluated in this report. However, there are no municipal supply wells within a four-mile radius of the HRW Project Area (ADEQ Well Database, 1999). Some historical sampling by the ADEQ and ADHS have shown concentrations of heavy metals (arsenic, cadmium, and lead) in the private drinking water wells. However, there was not sufficient QA/QC samples collected to verify the sample concentrations or to evaluate these concentrations against potential background concentrations of the same hazardous substances.



Groundwater in the Site area occurs in shallow aquifers 10 to 15 feet below the ground surface in faults, open joints, and planes of foliation in the weathered zones. However, some wells are drilled greater than 300 feet bgs due to low transmissivities of the geologic materials. The chemical character of the groundwater and surface water in the Prescott area is moderately mineralized (URS, 1994). The mean annual precipitation for the site area is 19.32 inches, based on the years 1898 to 2000 (ASU Climatology, 2001).

#### **4.4 SURFACE WATER PATHWAY**

Surface water runoff from the HRW study area enters the Hassayampa River and its tributaries which discharge into the Hassayampa Lake (upstream drainages) and flows downstream to the northwest (downstream drainages). Surface water samples were collected both upstream and downstream of Hassayampa Lake. Surface water samples were also collected upstream from each of the tailing piles/waste rock (but within close proximity) in order to compare samples that were unaffected by that particular tailings pile/waste rock. Also, due to the large amount of mines in the area and the possibility for other mines to influence the levels of contamination even in the upstream samples, background samples were collected from an area believed to be upgradient from the influence of all local mines, but still within the HRW Study Area. The background location was selected based on the same rock type.

##### **4.4.1 Hydrological Setting**

The HRW is located in the Prescott National Forest in a conifer forest at an elevation of 6,000 to 8,000 feet. The area is semiarid with precipitation and attendant high creek discharge occurring primarily during two periods of the year. The first period being winter storms and the resulting snowmelt and the second period being monsoon season typical of the late summer. In the early summer and again in late autumn, the discharge from the streams declines and at times, ceases entirely. Many of the smaller tributaries within the HRW study area flow only during spring and late summer. Some of the mines have shown visible discharges only during the high flow periods. No



stream gauges are located within the study area and the stream flows are estimated to be 5 to 10 cubic feet per second (cfs). Stream flows in the tributaries and the headwater reaches are approximately 1 to 3 cfs. Hassayampa Lake is located approximately 1-mile downstream from the headwaters. The general flow direction of the Hassayampa River within the study area is to the southwest. Beyond the study area the Hassayampa River flows to the northwest. The two-year, 24-hour rainfall figure is approximately 2.1 inches (URS, 1994). The mean annual precipitation for the area is 19.32 inches based on the years 1898 through 2000 (ASU Climatology Department, 2001).

#### **4.4.2 Surface Water Targets**

Neither the Hassayampa Lake, the Hassayampa River, nor the tributaries to the Hassayampa River are used as a primary drinking water source. A fishery is considered to be any area of a surface water body from which human food chain organisms are taken or could be taken for human consumption on a commercial, recreational, or subsistence basis. Although Hassayampa Lake is not considered to be a commercial fishery, Mr. Alan Anderson with the USDA Forest Service stated that he has seen people swimming and fishing in Hassayampa Lake, though not very often. The species of fish generally caught from Hassayampa Lake include the Gila Topminnow and the Desert Sucker, of which, humans can consume the Desert Sucker. Since Hassayampa Lake is only used for recreational fishing, no production data is available.

Mr. Mike Young of City of Prescott Water Production stated in a telephone conversation that a pipeline is in place to transfer water from Hassayampa Lake northward to Goldwater Lake, which over flows into Lower Goldwater Lake where a treatment facility is in place. According to Mr. Young, the treatment facility was shut down in 1988 for rehabilitation. To his knowledge, no rehabilitation efforts have been performed and the treatment facility is still not in operation. Mr. Young was not aware of any plans to permanently decommission the treatment plant. The Phone Conversation Log is included as Appendix I.



The Hassayampa River watershed is considered to be a habitat for the Federally-threatened Mexican spotted owl (*Strix occidentalis lucida*) and the Federal Category 2 candidate northern goshawk (*Accipiter gentilis*). A Category 2 candidate is listed by the United States Fish and Wildlife Service under the Endangered Species Act as a species being considered for listing. The Mexican spotted owl and the northern goshawk have been sighted within the HRW Study Area. The northern goshawk has been viewed bathing and possibly drinking water from surface water bodies in the HRW study area. The Mexican spotted owl may drink or bathe in the water if it is available. Eight or nine pairs of Mexican spotted owls have been spotted within the Prescott National Forest (URS, 1994).

According to the Wetlands Inventory Map dated 1995 for the Groom Creek, Arizona Quadrangle, three different wetlands classifications were present within the HRW study area. The three classifications and the corresponding eligibilities (HRS Guidance Manual, 1992) are as follows:

- Palustrine Unconsolidated Bottom - May meet the 40 CFR 230.3 definition of a wetland if emergent hydrophytes are present
- Riverine Intermittent Streambed - May meet the 40 CFR 230.3 definition of a wetland if emergent hydrophytes are present
- Riverine Lower Perennial - Generally will not meet the 40 CFR 230.3 definition of a wetland, except for some unique types of wetlands (e.g. some shoals or reefs)

#### **4.4.3 Surface Water Pathway Conclusion**

An observed release to the surface water pathway has been established through chemical analysis through the collection of surface water and sediment samples collected from the HRW. Arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, and zinc were detected at concentrations significantly greater than the corresponding background levels established for each media and rock type. The surface water and sediment samples used to establish the observed release